MATH 784: Partial Differential Equations I: 3 credits

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Lecture hours	MWF 10:00am–10:50am, NDSU Walster Hall, Room 315
Office hours	MWF 11:00am–12:00pm (or by appointment)
Textbook	Sandro Salsa. Partial Differential Equations in Action. From Modelling to Theory, Springer, Third Edition, 2016
Prerequisites	MATH 650, MATH 683, or the instructor's consent.
Course Description	Classification in elliptic, parabolic, hyperbolic type; existence and uniqueness for second order equations; Green's functions, and integral representations; characteristics, nonlinear phenomena.
Course Objectives	In this course a graduate introduction to the vast field of Partial Differential Equations (PDE for short) will be given. The first part of the course will be about classical approaches to construct explicit solutions to basic PDE. In particular, we will look at transport, wave, heat, and Laplace equations and basic properties of their solutions. In the second part of the course a more abstract approach to the existence of solutions of some PDE will be presented. In particular, we will discuss the so-called generalized functions and introduce the notions of weak solutions and Sobolev spaces. If time permits, a spectral problem for the Laplace operator will be discussed.
Class Attendance	According to NDSU Policy 333 (`www.ndsu.edu/fileadmin/policy/333.pdf`), attendance in classes is expected. The students are solely responsible for missed handouts or announcements made during the lectures.
Homework	There will be a weekly homework that will be collected and graded.
Exams	There will be a 50 minutes in class midterm exam, and a comprehensive 2 hour final exam. The exams are closed books, no calculators and/or cell phones are allowed.
Grading	The grading of the course will be based on the homework (50%), midterm exam (20%) and final exam (30%). The student will get A/B/C/D/F with the thresholds 90/80/70/60.
Academic Responsibility and Conduct	The academic community is operated on the basis of honesty, integrity, and fair play. NDSU Policy 335: Code of Academic Responsibility and Conduct applies to cases in which cheating, plagiarism, or other academic misconduct have occurred in an instructional context. Students found guilty of academic misconduct are subject to penalties, up to and possibly including suspension and/or expulsion. Student academic misconduct records are maintained by the Office of Registration and Records. Informational

resources about academic honesty for students and instructional staff members can be found at `www.ndsu.edu/academichonesty`.

Any student found guilty of academic dishonesty will receive a grade of 0 for the homework assignment, or quiz, or test, or exam in question. In addition, every such student will be reported to the Chair of Mathematics, the Dean of their major college, the Dean of the College of Science and Mathematics, the Provost, and the Registrar. The Registrar will add any such student to NDSU's Student Academic Misconduct Database. (Multiple entries in this database may result in additional sanctions from NDSU.)

SPECIAL NEEDS Any students with disabilities or other special needs, who need special accommodations in this course, are invited to share these concerns or requests with the instructor and contact the Disability Services Office (`www.ndsu.edu/disabilityservices`) as soon as possible.

COVID-19 If you feel any of the symptoms and/or have a fever of 100.4 or higher, self-isolate and do not come to the class.

SCHEDULE *Note:* This is a tentative schedule and subject to a change. Week 1 starts on Tuesday, December 12th.

Week 1. Introduction to PDE. Notation and classification of PDE.

Week 2-4. Separation of variables. Hilbert spaces.

Week 5-6. Diffusion.

Week 7-9. Laplace equation. Midterm exam.

Week 10-11. Scalar conservation laws.

Week 12-13. Waves and vibrations.

Week 14-15. Weak solutions and Sobolev spaces.

Week 16-17. Additional topics and review material.

Week 18. Final exam. May 11, Wednesday, 8:00am–10:00am.